NEUTRON SCATTERING FROM ELEMENTAL INDIUM, THE OPTICAL MODEL, AND THE BOUND–STATE POTENTIAL

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ABSTRACT

Neutron differential elastic–scattering cross sections of elemental indium are measured from 4.5 to 10 MeV at incident–energy intervals of ≈ 500 keV. Seventy or more differential values are obtained at each incident energy, distributed between ≈ 18° and 160°. These experimental results are combined with lower–energy values previously obtained at this laboratory, and with 11 and 14 MeV results in the literature, to form a comprehensive elastic–scattering database extending from ≈ 1.5 to 14 MeV. These data are interpreted in terms of a conventional spherical optical model. The resulting potential is extrapolated to the bound–state regime. It is shown that in the middle of the 50–82 neutron shell, the potential derived from the scattering results adequately describes the binding energies of particle states, but does not do well for hole states. The latter shortcoming is attributed to the hole states having occupational probabilities sufficiently different from unity, so that the exclusion principle becomes a factor, and to the rearrangement of the neutron core.